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ABSTRACT

Using meta analysis techniques from a 1977 article by G.V. Glass, this study sought to determine the effects of desegregation on academic achievement when students were grouped by academic subject, grade level, and length of desegregation. Data were obtained from 71 studies (conducted between 1955 and 1977) concerned with the effects of desegregation on academic achievement in children from grades K-12. The results indicate that the experimental (desegregated) groups in these studies benefited by 0.16 standard deviations. Differences were also observed by academic subject, grade level, and length of desegregation, although none of these differences was statistically significant. This study suggests that the meta analysis can be profitably used to expand the knowledge base in the area of desegregation and academic achievement. (Author/GC)

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A META - ANALYSIS OF THE EFFECTS OF DESEGREGATION ON ACADEMIC ACHIEVEMENT

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INTRODUCTION

Over the last 25 years this nation has spent tremendous sums of money to provide equal educational opportunity to people of all races. This money has been spent on court cases, desegregation plans, busing schemes and research in the area of equal opportunity, but we still do not have definitive answers as to the results of these efforts and expenditures. This research is an effort to provide more definitive guidelines as to the impact of efforts in the area of desegregation on academic achievement.

Many of the court decisions which have led to federal laws requiring integration were based on the assumption that segregated schools were not equal. The underlying assumption was that black children would not be provided the opportunity to develop to their full potential since the facilities, staff, materials, books, and equipment were inferior to those provided in all-white schools. It was further assumed that if blacks were allowed access to similar facilities that they would experience intellectual growth which would be superior to that which they could achieve in all-black schools (Brown vs. Board of Education of Topeka, 1954; Bolling vs. Sharpe, 1954).

However, the research relating academic achievement to integration has been contradictory. This is evident in a 1971 address to the American Educational Research Association by Walter Mondale on the subject of school integration.

> What I have not learned is what we should do about these problems. I had hoped to find research to support or to conclusively oppose my belief that quality integrated education is the most promising approach. But I have found very little conclusive evidence. For every study, statistical or theoretical, that contains a proposed solution or recommendation, there is always another, equally well documented, challenging the assumptions or conclusions of the first. No one seems to agree with anyone else's approach. But more distressing: no one seems to know what works. As a result I must confess, I stand with my colleagues confused and often disheartened (AERA, February, 1971, New York City).

Recently, St. John (1975) reviewed the desegregation literature to determine the outcomes for children. She concluded the following about desegregation and academic achievement:

> In sum adequate data have not yet been gathered to determine a casual relation between school racial composition and academic achievement. More than a decade of considerable research effort has produced no definitive positive findings. In view of the political, moral, and technical difficulties of investigation on this question, it is doubtful that all the canons of the scientific method will ever be met or a causal relationship ever established. Suggestive trends have been uncovered, however, as has one important negative finding: desegregation has rarely lowered academic achievement for either black or white children (St. John, 1975, p. 36).

She went on to say that if progress were going to be made in this effort to determine the causal relationship between academic achievement and desegregation,

we needed to pool, in some systematic manner, the original data from the studies and not rely on the words in the conclusions of the studies (St. John, 1975).

Recent methodological developments have provided a potential means to address some of the problems noted by Vice-President Mondale and Nancy St. John. In the Educational Researcher (November, 1976) article, Glass outlined a process that he labeled the "Meta Analysis of Research" which was intended to be a rigorous method for extracting knowledge from accumulated studies by integrating the results of many studies. In the same article, Glass described the differences between primary, secondary, and meta analysis of research.

To understand the goal of meta analysis one can think of the analysis of data at three distinct levels. The first level is "primary analysis." It is the analysis of data in a research study using conventional statistical methods. The next level is often referred to as "secondary analysis," which is the reanalysis of data for the purpose of answering the original research question with a different (or better) statistical technique or answering new questions from the old data. Examples of this type of activity are: the Mosteller-Moynihan secondary analysis of the Coleman study (1972); the Campbell-Erlebacher analysis of the Ohio-Westinghouse Headstart evaluation (1970); and the Elashoff-Snow secondary analysis of Pygmalion in the Classroom (1971) to name three.

The third level of data analysis, meta analysis, refers to the analysis of analyses. It has specifically been used as a statistical analysis of a large collection of reported statistics from individual studies for the purpose of integrating the findings.

In his article Glass used meta analysis techniques to answer the question, "Does psychotherapy benefit those who receive such treatment?" This was done by analyzing 400 controlled studies and statistically creating composite control and experimental (treatment) groups. The two groups were compared by calculating a mean effect size for the control and the experimental group. He found that the treatment group mean effect size was about two-thirds of a standard diviation above the control group mean on the outcome variable.

Statement of the Problem

Because there are many opposing opinions on the question of the effects of integration on academic achievement, this study was directed toward a search for a causal connection between integration and academic achievement of those minority children who were desegregated. Specifically it was directed toward answering the question, "Does desgregation lead to improved academic achievement of those minority children who were desegregated?" This investigation used the meta analysis technique as outlined by Glass (1976) for integrating reported research findings. In addition to the question of the general effect on academic achievement, there are also many concerns associated with specific differential effects of desegregation and achievement.

The first specific concern for this research was, "Are there differential effects of desegregation which are dependent on the educational level (grade level) of affected students?" This question is of particular relevance for it can be established that students who experience desegregated education in their initial years of education benefited more than those exposed in the later years of their education, there are clear policy implications. Critics of previous research (Pinkney, 1968, 1970; Mayer et al, 1974) have charged that the reason "non significant differences" are often shown in research in this area is because of the difficulty of impacting on students during the latter years of their education. The critics contend that studies involving students in grades K-6 often show greater effects (Anderson, 1966; St. John, 1975). Meta analysis could help to provide an answer to their conjectures.

The second specific concern is "Does desegregation lead to greater gains in certain subject areas than in others?" In the past research designed to answer this question has not been definitive although mathematics gains are reported more often than verbal or reading gains.

The third specific concern is "Is the amount of time in a desegregated educational environment related to achievement gains?" Here again, critics have charged that it is unfair to expect overnight changes in academic achievement based on only one year of desegregation. They contend that longer exposure to desegregated education will produce greater gains. This research is also designed to provide an answer to these critics.

Methods

The research hypotheses to be tested in the study are all concerned with the effects of desegregation on achievement. The type and quality of design used to accomplish the studies and the probability of positive outcomes are also examined. In other words it was assumed that as the quality of the design increased, the likelihood of positive results decreased. Meta analysis techniques are used to investigate this assumption.

The effects of desegregation on achievement and the effect of the quality of the design on reported outcomes will be assessed by the use of "effect size" (ES). According to Glass (1977) "effect size" is the difference between the means of the experimental and control groups. Effect size is considered to be a measure of treatment effectiveness. Treatments which produce large differences between experimental and control groups will produce larger "effect size" than those which do not produce such marked differences.

Effect size can be calculated by taking the difference of the experimental group mean and the control group mean divided by the standard deviation of the control group. The formula can be shown as follows:

$$ES = \frac{\bar{X}_E - \bar{X}_C}{S_X}$$

where: $\bar{X}_E$ = mean of experimental group

$\bar{X}_C$ = mean of control group

S_X = standard deviation of the control group

ES = effect size

The following are the research hypotheses for this study.

The first hypothesis can be considered the overall null hypothesis to be tested by the meta analysis technique. It is stated as follows:

H1: There is no difference in the academic achievement of the experimental group (desegregated) and the control group (segregated).

The second hypothesis is:

H2: There is a greater mean effect size for desegregated students at the elementary level than those at the secondary level.

It appears to be a direct contradiction of the first hypothesis which indicates no significant differences between groups. However, studies concerning desegregation with elementary (K-6) children have shown positive results more often than those involving secondary (7-12) children. Studies which showed significant achievement gains for the experimental group include those by Anderson (1966), Danahy (1971), Mahan (1968), Samuels (1971), Wolman (1964), and Wood (1969).

An effect like this should not be too alarming since educators have known for some time that it is much harder to make up achievement deficiencies after the seventh grade. Schramm's (1960) analysis of instructional television showed that gains were made in 33 percent of the studies in grades 3-9 and in only 13 percent of the studies concerned with instructional television at the high school level. In addition, St. John (1975) concluded that her review of the literature "indicates that younger children, especially those of kindergarten age, tend to benefit more than older children from desegregation." (St. John, 1975, p. 37) This also should not be too alarming, for if integration is a positive influential force it should have greater impact before students have experienced may years of negative forces. It should be easier to affect the learning of children who have experienced fewer years of academic failure in an inferior educational environment.

The third hypothesis is:

H3: Students in desegregated environments will show greater gains in mathematics than verbal skill. This hypothesis is concerned with determining if students in the experimental group gained more in mathematics than students in the control group. These gains will also be compared to gains in reading skills between the two groups.

This hypothesis is indicated by previous research. St. John (1975) stated, "gains in mathematical rather than verbal achievement are reported frequently enough to deserve further study". (St. John, 1975, p.37) Studies which tend to support this hypothesis are: Prichard (1969), Mayer (1970), Anderson (1966), Funtenberg (1959), Walker (1969).

The fourth hypothesis is:

H4: There is a greater mean effect size for students who have been in desegregated environments for more than one year when compared to those who have only one year in such an environment.

This hypothesis draws the supposition that if one year of treatment is good, two years are better. This is thought to be true for a number of reasons:

1. Much of education is dependent on previous learning. Therefore, if the previous learning is of a better quality than that provided for the control group, it is likely the subsequent learning will benefit by the longer exposure to "better education".

2. If desegregation has a positive impact on learning, it should have a greater effect the longer the child is exposed to this beneficial environment (treatment).

3. Also, there is no reason to expect desegregation to produce effects in the negative direction after one year's effects in the positive direction.

4. It is unrealistic to expect one year's exposure to counteract five or more previous years' exposure to inferior education. For example, one cannot expect the effects of 14 years of exposure to an unstable family life to be cancelled out by one year's exposure in a stable foster home.

The issue here is treatment level. That is, one should expect larger or greater exposure to a treatment to produce a greater effect until saturation occurs or the law of diminishing return prevails.

St. John (1975) concluded that length of exposure to desegregation has not proved to be an important variable, perhaps because most experiments or studies have been of too short duration for adequate comparisons to be made. This research compared studies of one year's duration to those of more than one year.

The fifth hypothesis can be stated as follows:

H5: There is a greater mean "effect size" shown when a meta analysis is performed on designs without control groups as compared to the designs with control groups. Both designs used a before and after measure of achievement.

The final hypothesis is concerned with "effect size" when the quality of the design used to compute the resulting effect size is taken into account.

It is assumed that designs which control for few sources of variance were likely to indicate greater effects than those designs which were likely to indicate greater effects than those designs which were better conceived and as such controlled for more sources of variance. Glass (1977) indicated that he would expect soft or weak designs to show significant differences more often than designs which controlled for as many sources of rival explanations as possible.

If the design used does not rule out all or most of the likely causes of a perceived effect, it is difficult, if not impossible, to attribute the effect solely to the treatment intervention. Weak designs control for fewer of the other likely causes. Therefore, observed effects may well be the result of some factor that was not accounted for in the design rather than the treatment.

Population

The population of studies for the purpose of this research includes studies on achievement and desegregation done during the years 1955-1977. However, it soon became apparent that a further delineation of the population was needed. Therefore, Glass's (1977) criteria for sorting were adopted. Only studies with the measure of achievement before and after desegregation were considered for the population. This process eliminated many studies that were descriptive, correlational or cross-sectional in nature.

A systematic review of the research literature on the effects of desegregation was completed in August of 1977. To insure that all published studies on desegregation and academic achievement were located, a list of the identified studies was sent to six people who are recognized experts in the area of desegregation. Three of the six experts replied. They generally agreed that they could not make any additions to the submitted list of studies.

RESULTS

EFFECT SIZE FOR ALL STUDIES

The first effect sizes to be calculated were for the total population of studies including all designs, all subjects, and all lengths of desegregation. Effect sizes were calculated by using one of the three methods as outlined by Glass (1977, 1976).

The results are shown in Table 1.

TABLE 1

EFFECT SIZE FOR ALL STUDIES

Total Number of Studies	Minimum Effect Size	Maximum Effect Size	Mean Effect Size	Standard Deviation of Effect Size
71	-1.17	1.13	.16	.41

The distribution of these data is fairly normal although it does have several discountinuities.

By reviewing Table 1 one can see that the experimental group benefited by 0.16 standard deviations. That is, the mean of the experimental group exceeded the mean of the control group by 0.16 standard deviation.

EFFECT SIZE BY GRADE LEVEL

In order to respond to hypothesis H2 and to test the assumption, in the literature, that students in lower elementary grades gain more than students in junior high and high school, the data were clustered into two groups by the grade levels of the students involved. One group consisted of studies involving students in grades K through 6 and the second group consisted of studies involving students in grades 7 through 12. Hypothesis H2 stated:

> There is a greater effect size for desegregated students at the elementary level than those at the secondary level.

Table 2 is a summary of the results for studies involving lower grade levels (k-6) and for studies involving upper grade levels (7-12).

TABLE 2

EFFECT SIZES FOR STUDIES INVOLVING
STUDENTS IN GRADES K-6 AND GRADES 7-12

Grade Levels	Total Number of Studies	Minimum Effect Size	Maximum Effect Size	Mean Effect Size	Standard Deviation of Effect Size
K-6	51	- .96	1.13	.22	.34
7-12	20	-1.17	.59	.01	.53

The mean effect size for students in grades K-6 is quite similar to the mean effect size calculated for all studies, however the effect size for students in grades 7-12 seems to be considerable smaller than for all studies and for the group of studies for grades K-6.

By comparing the two grade levels the reader can see that the effect size for the lower grades is considerable larger than the mean effect size for grades 7-12. In order to test the hypothesis (H2) a t test was performed to determine if the difference in the means was statistically significant.

The results indicate that the effect size for lower grade levels (K-6) is not statistically significantly greater than the effect size for the upper grade levels (7-12). This finding indicates that for this study sample desegregation does not influence learning more in elementary levels than it does in secondary levels even though the magnitudes of the effect sizes appear to be quite different (0.22, 0.01).

EFFECT SIZES FOR MATH AND VERBAL ACHIEVEMENT GAINS

Another contention in the literature is that students in desegregated settings gain more in mathematics achievement than they do in reading achievement. Because of this assumption it was decided to test this contention by means of hypothesis H3 which stated:

H3: Students in desegregated environments will show greater gains in mathematics than in reading or verbal skills.

To test this hypothesis the studies were clustered into a population of studies concerned with mathematic skills and a population of studies concerned with reading skill achievement. The process of separating studies into specific groups produced a problem with this group of studies that was not a problem with the other variables used to separate studies into categories for analysis. The problem is that when these studies were separated into a group of studies on verbal achievement and a group of studies on mathematics achievement it was evident that the test of independent means was not appropriate since most of the subjects in the verbal studies were the same as those who were involved in the mathematics studies. For example, of the total of the fifty studies which were appropriate for this analysis, thirty-four studies (seventeen pairs) were composed of the same subjects. Only three of the studies in the mathematics group of studies could not be matched with the same subjects in the verbal category of studies. Since the data were not based on independent groups it was appropriate to use the t statistic for dependent groups to test the difference in means between these two groups of studies (Glass and Stanley, 1970, p. 300). Table 3 is a summary of the effects for these two populations.

TABLE 3

EFFECT SIZE(S) FOR STUDIES WHICH USED MATHEMATICS OR VERBAL ACHIEVEMENT AS A DEPENDENT VARIABLE

Achievement Measure	Total Number of Studies	Minimum Effect Size	Maximum Effect Size	Mean Effect Size	Standard Deviation of Effect Size
Mathematics	17	- .99	.54	.17	.38
Verbal	17	-1.17	.47	.07	.33

These data seem to indicate that students' gains in mathematics are greater than their gains in verbal skills. The t test of dependent means was performed; the results yielded an obtained t value of 1.90 which is not significant at the .05 level

EFFECTS OF LENGTH OF DESEGREGATION ON ACHIEVEMENT

The next hypothesis to be tested concerned achievement gains for those students who were desegregated for one year as compared to those students who were desegregated for more than one year. This hypothesis stated:

H4: There is a greater mean "effect size" for students who have been in desegregated environments for more than one year when compared to those who have had only one year in such an environment.

Table 4 is a summary of the results for students desegregated for only one year compared to the results for students who were in a desegregated environment for more than one year.

TABLE 4

EFFECT SIZE(S) FOR STUDIES INVOLVING STUDENTS WHO WERE IN A DESEGREGATED ENVIRONMENT FOR ONE YEAR AND GREATER THAN ONE YEAR

Length of Desegregation	Total Number of Studies	Minimum Effect Size	Maximum Effect Size	Mean Effect Size	Standard Deviation of Effect Size
One Year or Less	37	-1.17	.59	.11	.48
Greater Than One Year	34	- .40	1.13	.21	

To test the significance of the difference in the mean effect sizes, a t test was performed. The results yielded a t value of 0.96 which is not significant at the .05 level.

EFFECT SIZE OF DESIGNS WITH A CONTROL GROUP VS. EFFECT SIZE FOR DESIGNS WITHOUT A CONTROL GROUP

The final hypothesis stated:

H5: There is a greater mean "effect size" shown when a meta analysis is performed on designs without a control group as compared to designs with control groups.

The results of the meta analysis on these two groups is shown in Table 5.

TABLE 5

EFFECT SIZE(S) FOR STUDIES WITH AND WITHOUT A CONTROL GROUP

Type of Design	Total Number of Studies	Minimum Effect Size	Maximum Effect Size	Mean Effect Size	Standard Deviation of Effect Size
With Control Group	33	-1.17	.59	.10	.42
Without Control Group	38	- .96	1.13	.21	.40

It is interesting to note that studies which were considered to be of a weaker design (no control group) did have a greater effect size than those studies which were considered to be stronger (with control group). This difference is in the direction indicated by the hypothesis. A t test was performed to determine if the difference was statistically significant. The results yielded a t value of 0.88 which is not significant at the .05 level.

SUMMARY OF RESULTS

This analysis showed that:

1. The overall mean effect size for all studies is 0.16 standard deviations.

2. The mean effect size for grades K-6 is 0.22 standard deviations and the mean effect size for grades 7-12 is 0.01 standard deviations. This difference was not statistically significant at the .05 level of significance.

3. The mean effect size for math achievement gains is 0.17 and the mean effect size for verbal achievement is 0.07. This difference was not statistically significant at the .05 level of significance.

4. The mean effect size for studies of one year is 0.11 while the mean effect size for those studies that were greater than one year is 0.21. The difference was not statistically significant at the .05 level.

5. That the mean effect size for control (comparison) group designs is 0.10 standard deviations while the mean effect size for studies which did not use a control (comparison) group was 0.21 standard deviation. The difference was not statistically significant at the .05 level.

CONCLUSIONS

One of the problems that has perplexed consumers of social science research is how to compare the findings of two or more existing studies that have conflicting results. This problem often arises because the studies have dissimilar designs, vary in overall research quality, use different instruments or methods to measure the dependent variables, or are conducted at different times.

It is also true that the consumer of these studies is not able to resolve the issue of conflicting results even with studies of similar design, overall research quality, etc. In other words, readers have no way of determining the "truthfulness" of the results of opposing studies based on quality, design, instrumentation, etc. Therefore, when readers are faced with the dilemma of resolving conflicts with regard to the results of two or more studies, they often revert to the system of values and beliefs they possess about the relationship among the variables in question. This type of behavior may be appropriate for the general public or even theory builders within the social sciences, since their beliefs can be challenged and debated before a consensus arises with regard to the relationship of the variables debated.

However, as the research in question moves away from the theoretical end of the research continuum toward the applied research end, "truth" should not be simply a restatement of accepted values and assumptions. If we accept the wrong study as true, the consequences of intervention can have devastating effects on resource allocation and on the lives of persons in the program. When individuals' lives will be directly affected by the applied research, we must not rely on personal belief systems and value judgments but should employ a thorough rational process of causal inference.

When we are using the results of research to formulate policies that will determine the design of social programs, we need to know the actual or most probable relationship between the variables if we are to design an appropriate intervention. If we are creating programs that are designed in the belief that X causes Y, and, in fact, Z causes Y, we are simply wasting the taxpayers' money since the program is likely to have no effect.

It is evident that mistakes can be made in basic and applied research and in evaluation and that these mistakes can be costly in both human and monetary terms. Improved methods of assuring the accuracy of decisions that are based on research and evaluation are thus needed.

The meta analysis technique has a great potential for bringing some rationality to decision areas that are particularly controversial and inherently political such as desegregation. While it is well recognized that meta analysis, or any other research technique, cannot or will not replace the current system of making such decisions, it is hoped that it can help put claims and counterclaims into proper perspective.

The policy decisions which could be impacted by a meta analysis of the studies on desegregation include the following:

1. How should money for compensatory education be spent most effectively? For example, if integrated black children make good gains in math but not in verbal skills, it would seem probable that more federal money should be spent on delivering compensatory math than on compensatory programs designed to improve verbal skills and that additional money should be invested in research and development in the area of reading and writing.

2. At what grade level(s) should efforts to integrate education be particularly emphasized? If children who experience integrated education in earlier grades seem to benefit more than those children who experience integration in the later years of their education, this could indicate a direction for future federal efforts to implement integrated education in the lower grade levels.

3. What are the long-term effects of desegregated education on black and white children? Although this meta analysis research was not designed to investigate the long-term effects of desegregation, it might be possible to track the educational progress of those children who experience integrated education to find out if their educational career goals or life goals differ from those who experience segregated education. In other words, there may be long-term and worthwhile effects of desegregated education that have policy implications.

4. If the effects of desegregation on academic achievement seem to be minimal or nil, federal policymakers should ask WHY? The assumption has been that black children will benefit by an integrated educational experience; if they do not, it might indicate that research should go to the next lower level of the educational process. That is, it might not be sufficient to examine the effects of desegregation at the district or school level. Further efforts might be directed at finding out what happens in the classroom and in the particular interactions between teacher and integrated child. This meta analysis effort is at the macro level and cannot answer the "why" aspect of the outcomes.

IN RETROSPECT

The experience of conducting this meta analysis has provided some evidence that the meta analysis approach may be an important contribution to social science methodology if it can be applied and tested on a wide range of aggregation problems. It should not be accepted as a panacea to the aggregation problem since efficacy of meta analysis has yet to be fully established. The main thought that the reader should gain from this study is that meta analysis is a new technique that seems to have more advantages and less disadvantages than some of the other analytical approaches to doing integrative reviews. However, it is not a fully developed approach as of this time. Therefore, all results must be interpreted with care.

Several major concerns in this study could profitably be explored by other meta researchers to further the development of meta analysis techniques and contribute to the knowledge base in the area of desegregation and academic achievement. These include the following:

1. A meta analysis of unpublished studies in the area of desegregation and academic achievement should be accomplished and compared to the results of this study.

2. More work must be done to determine the practical significance of calculated effect sizes. If meta analysis has any hope of being useful to policy makers and administrators, some attempt must be made to introduce practical considerations into the summary statistics.

3. Research should be done to determine the validity of the various methods used to calculate effect size. Several methods had to be used in this study although the comparability of resulting effect sizes has not been established at this time.

4. More work must be done to determine the effect of using unequal group sizes to calculate a mean effect size. At the present time, meta analysis techniques using effect size are used to aggregate all studies without regard to the sizes of the groups used in the original individual studies. Therefore, the effect size for a study which used 50 subjects is calculated in the same manner as a study which used 1,000 subjects. It seems clear that a method should be developed to calculate effect sizes based on the sizes of the groups in the original studies.

5. Much more work must be done in the study of the relationship between desegregation and achievement. It is clear that desegregation in education is the law of the land yet we have little or no research evidence that indicates positive effects of desegregation on achievement. This is a call for high quality research to establish causal links between these two variables although it must be conceded that these links may not exist.

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